

February 2014

Hunting Ammunition and Implications for Public Health.

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Summary of Findings:

- Multiple types of hunting ammunition are available with varying ballistics and public health implications
- Game meat harvested with lead ammunition may be contaminated with lead fragments
- Ingestion of lead fragments in game meat may present health risks, especially to women and children. There is no level of lead exposure in children known to be without adverse effects
- Public health risks can be mitigated by use of alternative hunting ammunitions

Background:

Hunting is a popular outdoor recreational activity throughout the United States, providing both benefits to human health (enjoyment of the outdoors, exercise, social interactions) and a source of food (lean protein). There are over 10 million deer hunters in the United States spending \$33.7 billion annually which supports state and local economies as well as natural resource management.¹ Hunter-harvested game is used as a source of meat for individual families, and also, through donations, is an important source of protein for food shelves.² More than 2.5 million pounds of game meat is donated annually in the United States and Canada. Minnesota's Department of Natural Resources (DNR) coordinates a venison donation program, recognizing that it helps families in need as well as provides additional management for deer populations.³ Following the discovery that tiny lead fragments are frequently dispersed throughout the meat harvested with lead ammunition, the potential threat to public health spurred new requirements for venison donations. Currently all hunter harvested venison in Minnesota (MN) must be x-ray scanned prior to donation.³ The magnitude of the public health risk varies based on the type of ammunition used and its metal content.

Hunting ammunition

	Common Use	Exposure potential	Risk potential
Lead shot	Upland game birds, deer	Minimal fragmentation of pellets and dispersal	Lead: toxic* Easily detected
Steel shot	Waterfowl	Minimal fragmentation of pellets and dispersal	Steel: non-toxic Easily detected
Lead bullet	Deer hunting, large game	**Fragmentation of bullet and broad dispersal, up to 14" from bullet path ⁴	Lead: toxic * Fragments not always detectable by consumer
Copper bullet	Deer hunting, large game	No fragmentation of bullet or dispersal	Mammals tightly regulate copper storage, thus only long-term high dose exposure poses a potential health threat. ⁵

* Lead toxicity - Interferes with development of nervous system; Toxic to heart, intestines, kidneys, and nervous system⁶

** See images

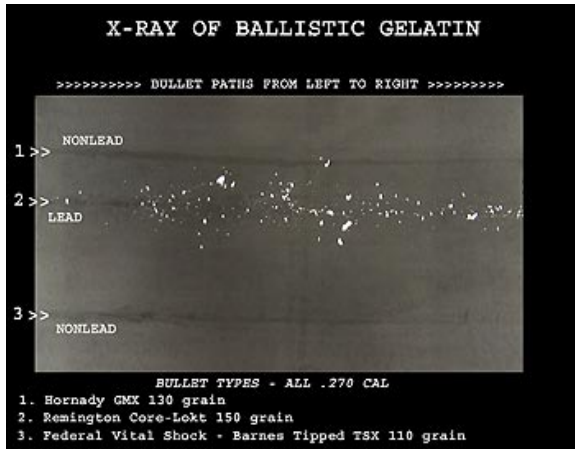
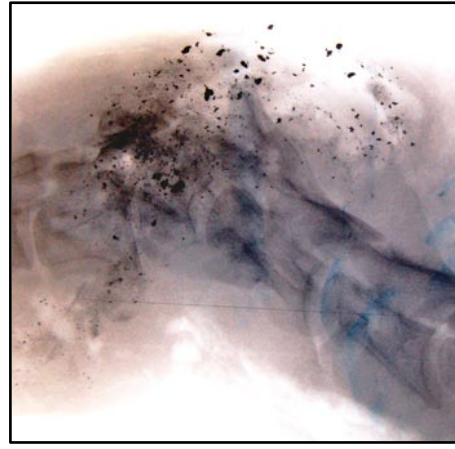


Image showing fragmentation of lead and non-lead ammunition passing through ballistic



Radiographic demonstration of lead bullet fragmentation in sheep carcass⁵

Public Health Considerations:

Lead hunting bullets fragment upon impact. Wildlife officials investigating lead toxicity in non-target species (eagles, condors) discovered that lead fragments disperse widely in the carcass and gut pile of deer shot by hunters, causing adverse health effects for animals that scavenge these carcasses.⁸ These same health risks apply to humans because fragments may be ingested when the meat is processed for food. While lead shot is usually detected while eating and discarded, the lead 'dust' dispersed in meat by fragmentation of lead rifle bullets cannot be easily detected. Fragmentation leads to increased bioavailability of the lead and associated public health risk. Studies have shown:

- Elevated blood lead levels in hunters who regularly consume game meat shot with lead ammunition.^{9, 10, 11}
- Elevated blood lead levels in pigs after ingestions of venison shot with lead ammunition.¹²
- Fragments of lead bullet in 26–60% of ground venison packages from commercial processors.^{4, 13}

At risk populations include 10 million deer hunters and their families in the United States, as well as low income recipients of donated venison. In 2008, food banks had to remove venison contaminated with lead from their shelves.¹⁴ The Centers for Disease Control and Prevention (CDC) states there is no level of lead exposure in children known to be without adverse effects.¹⁵ Based on these recognized health risks, **MN, Wisconsin and North Dakota wildlife agencies and state health departments have recommended that pregnant women and children do not eat any game harvested with lead ammunition.**^{14, 16, 17} Additional human health studies are needed to determine the extent of ill health effects that lead ammunition is having.

Alternatives to lead rifle bullets are available; costs of ammunition types vary with copper rifle ammunition comparable to premium grade lead ammunition. Copper rifle ammunition has been demonstrated to be effective with excellent ballistics and quick kill, two issues important to hunters.¹⁸ Another important issue is availability in terms of calibers and bullet weights, which is improving, but small retailers need to carry non-lead ammunition in addition to the larger 'big box' stores.

Policy options

Non-lead ammunition is recommended to help ensure both a healthy environment for wildlife and safe food for humans, especially when deer-hunting with rifles. Multiple professional and scientific organizations have passed resolutions recommending the phasing out of lead ammunition.^{19, 20, 21, 22, 23} Policy options adopted by other states include:

- Voluntary grassroots efforts through hunter education and ammunition exchange programs.
- Regulation of lead in ammunition – in 2013, California became the first state to ban lead ammunition for hunting throughout the state.

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